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(54) Assaying interferons.

(57) Antiserum which can recognise all sub-types of human leukocyte interferon is prepared from the blood of an animal immunised with partially purified human leukocyte interferon obtained from a culture of human leukocyte stimulated with Sendai virus.

The antiserum is added to a column whereon concentrated culture broth of human leukocyte has been immobilised to absorb impurities, the effluent is added to a column whereon partially purified human leukocyte interferon has been immobilised to absorb anti-human leukocyte interferon antibody and then the antibody is eluted from the column.

The antibody thus obtained recognises all sub-types of human leukocyte interferon and can be separated by a chromatography of each monoclonal antibody which recognises a single sub-type.

Employing these antibodies, the sub-types of human leukocyte interferon or their antibodies in a sample can be analysed or assayed.

EP 0 431 950 A1

ASSAYING INTERFERONS

The present invention relates to processes for producing an anti-serum and an antibody capable of recognising a wide range of sub-types of leukocyte interferons and to methods of assaying or analysing sub-types of interferons derived from leukocytes and antibodies against the said sub-types, and to materials usable for such methods.

Human leukocyte interferon, also being called human interferon alpha, is known to exhibit antiviral and anti-tumour activities, and its clinical application has already been started. The recently commercialised genetic engineering has quickly been applied to the product and has prompted greatly the analyses of the genes for interferons. The human interferons are classified into three types, or alpha, beta and gamma, according to the differences in kind of the cells from which they are derived and their physio-chemical properties. With reference to the beta-interferon, two molecular species have been reported to exist, while one molecular species has been described for the gamma-interferon. In contrast to these interferons, the alpha-type of interferon is known to exist as a great variety of sub-type as many as more than 20 kinds (Goeddel et al., Nature, 287, 411 (1980). Pestka et al., 1987 Annual Review of Biochemistry, 56, 727), and extensive investigation has been carried out into the commercialisation of the said interferon. As an analysis for such interferons, however, there has been used a extremely complicated technique which comprises purifying each of the sub-types to a high degree of purity, followed by amino acid sequencing (Rubinstein et al., Proc. Natl. Acad. Sci. USA, 76, 640 (1979)). The individual sub-types, although containing a particular amino acid sequence in common, differ each from the other partially in amino acid sequence and have been clarified to be mutually independent gene expressions. In exerting their activities, they offer different specific features in species-specificity spectrum of antiviral activity, etc., and are considered to share physiological activities or co-operate among each other in some form in living body.

Nevertheless it is quite difficult to be considered that such subtypes allow all of their genes to undergo expression in living body, and though the protein sequencing analysis of the subtypes presents an important problem in the analysis of their activities, the lack of a simple and convenient analytical technique has made the range of findings extremely restricted and limited in this field (Adolf et al., J. Gen. Virol., 68, 1669 (1987)). After recombinant alpha-type interferon produced by use of genetic engineering has been initiated to be applied to humans, in addition, the production of neutralizing antibody against interferons is in recent years observed at high frequencies.

[The Problem Which the Invention Is Intended to Solve]

In view of the fact that recombinant interferon is composed in nature of a single subtype, the incidence of such a kind of antibodies is assumed to nullify the effect of the administered interferons, and can be considered the critically serious problem from the viewpoint of clinical application. Also, such a kind of antibodies is thought to neutralize the activities of the interferons that the human body produces as a part of its own defense mechanism, and is presenting an entirely novel category of problem. Yet, the lack of an effective evaluation procedure of antibodies has resulted in failure to accumulate relevant findings. As is stated in the above, the development of a simple, convenient and quick analyzing method for the subtype compositions and antibodies is strongly demanded from the standpoints of fundamental science and clinical application. For the purpose of analyzing all the naturally occurring subtypes, it is necessary to prepare the antibody using as an antigen the partially purified interferons containing all subtypes. In preparing the antibody, it is preferable to immunize two species of animals in order to establish an analysis technique based on the sandwitch type enzyme-antibody assay through the two-antibody method, but it may also be possible to prepare the antibody with use of one species of animal, followed by direct enzyme-labelling of part of the antibody to perform sandwitching. In either case, the resulting antibody must be a polyclonal antibody capable of recognizing all the subtypes. For the purpose of this, it may be possible to use a suitable mixture of monoclonal antibodies against individual subtype, but it is difficult to establish the hybridomas which can produce such antibodies. This is because this technique suffers the defects that (1) all the subtypes of interferons must be isolated and purified in fairly large quantities, (2) individual cell fusions must be effected, (3) the cells capable of producing the antibodies must be screened and furthermore the resulting antibodies can only recognize one antibody-determining portion out of the protein of each subtype, leading to a very fair possibility of escaping detection in the case of subtype produced only in very minute quantities. In the case of a polyclonal antibody against leukocyte interferon, contamination with antibodies against impurities contained in the purified sample is likely to take place, and this must be absolutely avoided.

The present inventors found that all the subtypes contained in the unpurified culture broth (crude interferon solution) of human leukocytes were present in partially purified human leukocyte interferon, and on the basis of this finding, prepared an antibody using them. Further purification through absorption of such antibody led

to the discovery that there can be obtained the highly specific antibody against leukocyte interferon which recognizes all the subtypes of interferon but not any antigen other than these at all. In the next place, the present inventors established the technique of high performance liquid chromatography (HPLC) which can permit simple but efficient fractionation of subtypes of interferons from one subtype to another. The antibody thus obtained recognises all sub-types of human leukocyte interferon and can be separated by a chromatography of each monoclonal antibody which recognises a single sub-type. Reverse phase high performance liquid chromatography may be used. And it was further clarified that the enzyme-antibody method through the combination of these findings can perform exceedingly simplified detection of the sub-type compositions similar to the biological activities, and these have permitted completion of the present invention.

The present invention provides a process of producing an antiserum capable of recognising a broad range of sub-types of leukocyte interferons of a species, which comprises immunising an animal with partially purified leukocyte interferon which is obtained by purifying a culture, or an extract of a culture, of leukocytes stimulated to produce interferon, by precipitation with an alkali rhodanide under acidic conditions and by precipitation from ethanol, and recovering the serum from the animal, and includes an antiserum so produced.

Preferably the leukocytes are stimulated with a virus, preferably Sendai virus.

Preferably, the antiserum is capable of recognising human interferon sub-types, preferably all sub-types of human leukocyte interferons.

Preferably, the precipitate from the supernatant liquid from a said culture obtained by precipitation with an alkali thiocyanate is extracted with ethanol and interferon is precipitated therefrom by raising the pH.

The invention includes a process for producing an antibody capable of recognising a broad range of sub-types of leukocyte interferons of a species, preferably human leukocyte interferon sub-types, comprising purifying an antiserum containing said antibody by affinity chromatography and includes an antibody so produced. In particular, the invention includes a process of this type which comprises passing an antiserum capable of recognising such sub-types of leukocyte interferons of a species through a column having a concentrated culture broth of leukocytes of the same species immobilised thereon to absorb a leukocyte interferon antibody and then washing the column, followed by elution of the said antibody.

Preferably, the antiserum is first contacted, e.g. in a column, with an immobilised culture or extract thereof of leukocytes of the same species which have been cultured in the absence of an added interferon production stimulus, by said contacting to remove impurities.

Preferably, the antiserum is a product obtained by immunising an animal with partially purified human leukocyte interferon which is obtained by purifying a culture, or an extract from a culture, of human leukocytes stimulated to produce interferon, by precipitation with an alkali rhodanide under acidic conditions and by precipitation from ethanol, and recovering the serum from the animal.

The invention includes, a method of assaying a sub-type of human leukocyte interferon in a sample, which comprises allowing a polyclonal antibody obtained by a process as described above to act on the sample.

Preferably, the assay is performed using an enzyme-antibody method such as a sandwich assay.

The leukocyte interferon may be a lymphoblast type interferon.

The leukocyte interferon may be a recombinant interferon.

A said sandwich method may be conducted using polyclonal antibodies each obtained by a process as described above which are each obtained through immunisation of a respective one of two species of animals.

The specimen is preferably one fractionated by column chromatography, preferably be reverse-phase high performance liquid chromatography.

The invention includes a method of analysing an anti-leukocyte interferon polyclonal antibody, which comprises allowing a sub-type fraction of leukocyte interferon obtained by column chromatography to act on the said leukocyte interferon polyclonal antibody.

The anti-leukocyte interferon polyclonal antibody may be enzyme-labelled before or after acting on said leukocyte interferon fraction.

The anti-leukocyte interferon polyclonal antibody may be a patient's serum.

The invention includes a method for separating sub-types of leukocyte interferons from a mixture thereof comprising subjecting said mixture to reverse phase high performance liquid chromatography.

In an alternative aspect the invention is concerned with a process of producing an antiserum capable of recognising all the sub-types of hum leukocyte interferons, characterised in that said process comprises immunising an animal with partially purified human leukocyte interferon obtained from a culture product of human leukocytes stimulated with Sendai virus, followed by collection of serum from the animal ; a process of producing a polyclonal antibody capable of recognising all the sub-types of human leukocyte interferons, characterised in that said process comprises passing an antiserum, as obtained by the above-described process, through a column having a concentrated culture broth of human leukocytes immobilised thereon to thereby absorb an antibody against human leukocyte interferon and then washing the column, followed by elu-

tion of the above antibody, and a method of analysing the said antibody, characterised in that said method comprises detecting an antibody against a sub-type of leukocyte interferon in a sample through the antigen-antibody reaction using the said sub-type as fraction-collected by means of column chromatography.

In accordance with the preferred practice of the invention human leukocytes are suspended in a suitable culture medium (for example, Ham F12 culture medium), and the resulting suspension is admixed for example with a suitable quantity (50 to 200 HA) of Sendai virus, followed by cultivation to thereby produce crude interferon. The above procedure can be performed by means of the known method (Cantell et al., Methods in Enzymology, 78, 29 (1981)). Subsequently, the crude interferon can further be purified with use of a technique (Cantell et al., ibid., 499) consisting of combination of precipitation with an alkali rhodanide such as potassium rhodanide under acidic conditions and ethanol precipitation to thereby give partially purified human leukocyte interferon.

The partially purified interferon obtained by the above-described procedure, when used to immunize an animal, can yield, in the form of its serum, an antiserum containing antibodies against all the subtypes of human leukocyte interferon. Though removal of antibodies against impurities contained in such polyclonal antibody has heretofore constituted an extremely difficult problem, it now has been proven that the problem can be solved by enhancing specificity through affinity chromatography using an impurity immobilized column and an interferon-immobilized column.

In the present invention, the antiserum as obtained by the above procedure is passed through a column having a concentrated culture broth of human leukocytes immobilized therein to remove antibodies against impurities, and the effluent is passed through a column having the above-stated, partially purified human leukocyte interferon immobilized therein to absorb the antibody against the human leukocyte interferon, whereupon the column is washed, followed by elution for the antibody. For the elution, for example, there can be used a buffer composed of 0.1M citric acid-0.5M sodium hydrochloride. The resulting antibody can be purified by use of protein A Sepharose, etc. as is conventionally the case with this field of art. In cases where the subtype of leukocyte interferon is analyzed by use of the sandwitch immunoassay method, leukocyte interferon must in the first place be fractionated. For the purpose of this, a variety of chromatographic technique can be applied, and HPLC using a reverse-phase column can perform the best separation and is the most suitable in terms of reproducibility and quickness. In the case of conveniently simplified testing, for example, an antibody (antibody A, e.g. equine antibody) against leukocyte interferon is coated in advance on a microplate provided with 96 holes, and a highly concentrated protein solution, such as 1% bovine serum albumin solution, is distributed in suitable volume. The eluate from the column, as divided into fractions in accordance with the retention time, is collected in each hole of the thus prepared plate. After a suitable length of time is allowed, the plate is washed, and the reaction is allowed to proceed with a diluent of an antibody (antibody B, e.g. caprine antibody) derived from an animal of a species different from the one from which the antibody used for coating is obtained. After the plate is washed again, the reaction is allowed to proceed with an enzyme-labelled antibody against the antibody B. After the above described procedure is performed, the enzymatic activity becomes detectable in the holes where either subtype of interferon is present. Strength of enzymatic activity can be measured in terms of the extent of coloration. Alternatively, a substrate is added to the plate as such, whereupon strength of enzymatic activity can be quickly measured by means of a plate reader. Also, the extent of coloration can be plotted as a function of a length of time of elution from the column to prepare a graph, which can not only facilitate analysis of the subtype existence pattern but also enables their ratio to be quantitatively determined quickly and simply. Furthermore, a patient serum being used as the antibody B can be treated with anti-immunoglobulin of human origin or protein A which has been enzyme-labelled to thereby detect the antibody in the patient serum and also to analyze its specificity easily.

Thus, according to the present invention, there are provided the antisera and polyclonal antibodies capable of recognizing all the subtypes of human leukocyte interferon as well as the simplified method of assaying and analyzing the said subtypes and their antibodies in a specimen with use of the same.

Referring to the drawings, Fig. 1 shows the results of SDS gel electrophoresis with the partially purified human leukocyte interferon as obtained in Example 2, followed by allowing the proteins on the gel to migrate electrically to a nitrocellulose membrane to thereby perform the Western blotting, wherein A and B designate the results in the cases of equine serum against human leukocyte interferon and purified equine antibody against human leukocyte interferon, respectively, with the lanes 1 and 2 indicating electrophoretic transfer under reductive and non-reductive conditions, individually.

Fig. 2 and Fig. 3 are graphs showing the test results in Example 3, wherein Fig. 2 indicates peaks of HPLC fractions of human leukocyte interferon as measured with use of the antibody according to this invention, with Fig. 3 giving interferon activity peaks of the same HPLC fractions.

Fig. 4 is a graph showing the test results with a patient's serum being positive to the interferon antibody by use of the enzyme-antibody method while utilizing each of subtypes of interferons fraction-collected in adv-

ance.

The present invention is explained further by the following examples.

Example 1

Fresh blood, drawn within 48 hours, was centrifuged at 2,600 rpm for 10 min, and the resulting leukocyte layer (buffy coats) was collected. Erythrocytes being mingled with leukocytes were allowed to undergo hemolysis by admixing the buffy coats with 9-fold volume of cold ammonium chloride solution (0.83%), followed by centrifugation to give purified leukocytes as a precipitate. The leukocytes were suspended in a culture medium at a concentration of 10^7 cells/ml, whereby as the medium, there was used HAM F-12 Medium (produced by Flow Co.) being admixed with 4% of human serum freed from gamma-globulin and 50 ug/ml of gentamycin. Sendai virus was added to the suspension of human fresh leukocytes at the final concentration of 100 HA/ml, followed by incubation at 37°C for 2 hours. Then, incubation was continued overnight at a temperature declined down to 28°C. The culture broth was centrifuged, and the resulting supernatant liquid was found to contain 50,000 units/ml to 200,000 units/ml of interferon (10^4 Int'l units/mg protein) and was to be used as a crude interferon solution. 100 liters of the crude interferon solution was admixed with potassium rhodanide (manufactured by Wako Pure Chemicals Ind. of Japan) to a final concentration of 0.5 mole, followed by adjustment to pH 3.5 to yield a precipitate. The precipitate was admixed with 20 liters of 95% cold ethanol, and the mixture was vigorously stirred in a blender to extract interferon contained in the precipitate. Proteins, particularly albumin, other than interferon was allowed to precipitate at a pH of 5.5 and removed through centrifugation, and then, the supernatant liquid was adjusted at pH 8.0 to give interferon in the form of a precipitate. The precipitate was dissolved in phosphate-buffered isotonic saline (pH 7.4) as formulated by Dulbecco to produce a partially purified interferon solution in yields of 30 to 80% (10^5 Int'l units/mg protein). The partially purified human leukocyte interferon obtained by this procedure was given to a goat and a horse for immunization. In performing the immunization, the interferon as brought into an emulsion with complete adjuvant was injected subcutaneously to the animals at the single dose of 2×10^7 units once a week for consecutively 3 months, with 2×10^3 units being applied as the final dosage, and one week later, blood samples were taken to give sera.

The resulting antisera were found to show the antibody values as tabulated in Table 1.

TABLE 1

	Equine Serum			Caprine Serum		
	Volume ml	Neutral'n value,/ml	Protein mg/ml	Volume ml	Neutral'n value,/ml	Protein mg/ml
Serum	100	50,000	60	130	60,000	55
Impurity[1)]	280	15,000	3	350	18,000	5
Interferon[2)]	15	250,000	18	15	310,000	28

Notes: The neutralisation value is expressed in terms of dilution ratio of antibody solution that permits 100 units/ml of interferon activity to be attenuated to 10 units/ml.
1), in column effluent.
2), in column eluate.

Example 2

In order to produce an antiserum having extremely high specificity toward human leukocyte interferon, the following treatment was carried out: there was performed the same procedure as described in Example 1 for the preparation of crude interferon solution, except that Sendai virus was not added, to thereby give a culture broth of human leukocytes. The culture broth was concentrated (5 mg/ml) and immobilised on 20 ml of bro-

mium-cyanide activated Sepharose (manufactured by Pharmacia Co.), followed by packing into a column (1.5 cm in diameter × 10 cm in length). The column (Mock column) was buffered with phosphate-buffered isotonic saline (PBS), and each of the antisera as obtained in Example 1 was passed through the column. This procedure removed antibodies against any antigens other than interferon through absorption on the column.

By following the same procedure as described previously, a Sepharose column having the partially purified interferon immobilized thereon was prepared and after being buffered with PBS, was loaded with the effluent from the above Mock column. The column was washed well with PBS, and the absorbed antibody against interferon was eluted with an eluting solution composed of 0.1 M citric acid-0.5 M sodium chloride. This procedure permitted not only removal of antibody proteins against any antigens not being derived from the leukocyte culture broth but also concentration of the antibody against interferon. The resulting antibody was assayed for specificity by way of the Western blotting method (Towbin et al., Proc. Natl. Acad. Sci. USA, 76, 4350 (1976)), as is conventionally usual in this field. The results are shown in Fig. 1. The interferon antibody after being purified showed specific blots only in the portions corresponding to the mobility of interferon. This procedure yielded the antibody that reacted only with human leukocyte interferon. Through the experiment to be described in Example 3, investigation was conducted to find out whether or not this antibody would be able to recognize every and all of the subtypes contained in a culture broth of human leukocytes being stimulated with Sendai virus.

Example 3

Using the antibody as obtained in Example 2, the enzyme-antibody method was performed ; equine antibody against interferon was diluted to 0.1 ug/ml with PBS. The diluted antibody was distributed in 0.1 ml portion into each hole of a plate manufactured by Nunc Co.) provided with 96 holes and maintained at 37°C for 1 hour. The plate was inverted to discard the contents, and PBS (APBS) containing 1% of bovine serum albumin (manufactured by Sigma Co.) was distributed in 250 ul portion into each hole of the plate and maintained at 37°C for 30 min. The HPLC eluate to be described below was collected into the individual holes of the plate in the order of a length of the column retention time. In conducting HPLC, the C18 column (Hipore RP-318, manufactured by Biorad) was loaded with 30 million units of human leukocyte interferon in the presence of 0.1% trifluoroacetic acid (manufactured by Wako Pure Chemicals Co.), and eluted with 25% to 75 5 gradient acetonitrile, followed by washing each hole three times with 250 ul of PBS (TPBS) containing 0.05% of a surfactant (Tween 20, manufactured by Biorad Co.). Caprine antibody against interferon was diluted with APBS to a concentration of 0.1 ug/ml, and the diluted antibody was distributed in 0.1 ml portion into the individual holes and maintained at 37°C for 1 hour. After washing three times with TPBS, a 1,000-fold diluted solution of peroxidase-labelled anti-goatimmunoglobulin G (manufactured by kappel Co.) with APBS was distributed in the holes and maintained at 37°C for 1 hour. After washing with TPBS, the holes were subjected to coloration by use of the peroxidase-substrate kit supplied by Biorad Co. The coloration patterns are shown i Fig. 2. For the purpose of reference, shown in Fig. 3 are the patterns of interferon activity (antiviral activity) for the eluates collected in the same manner. The antiviral activity was determined with the Diapty method using FL cells and VSV. The results revealed that all the peaks showing antiviral activity were detectable by means of the enzyme-antibody method utilizing the antibody as obtained by the procedure as described herein.

Example 4

A subtype derived from human leukocyte interferon as collected in advance was diluted with PBS to a concentration of 5 ug/ml, and the diluted subtype solution was distributed in 100 ul portion into each hole of a plate provided with 96 holes and maintained at 37°C for 1 hour to allow immobilization. Then, APBS was distributed in 150 ul portion into the individual holes and maintained at 37°C for 30 min to block non-specific adsorption. After the holes were washed with TPBS, a patient's serum which had been confirmed to contain the antibody against interferon was diluted 100-fold into APBS and the diluted solution was distributed in 100 ul portion into the holes. As a control, equine antibody against interferon was diluted with APBS to a concentration of 0.1 ug/ml and distributed in 100 ul portion into the holes. After being maintained at 37°C for 1 hour, the holes were washed with TPBS, and a 1,000-fold diluted solution of alkaline phosphatase-labelled anti-human immunoglobulin G in APBS was poured in 100 ul portion into the individual holes, whereas a 1,000-fold diluted solution of alkaline phosphatase-labelled anti-horse immunoglobulin G (manufactured by Biosis Co. of France) in APBS was filled in 100 ul portion into the control holes. After maintaining at 37°C for 1 hour and washing with TPBS, the holes were subjected to coloration with use of alkaline phosphatase substrate kits manufactured by Biorad Co. The results are shown in Fig. 4 for a number of runs using different sub- types.

Claims

1. A process of producing an antiserum capable of recognising a broad range of sub-types of leukocyte interferons of a species, which comprises immunising an animal with partially purified leukocyte interferon which is obtained by purifying a culture, or an extract of a culture, of leukocytes stimulated to produce interferon, by precipitation with an alkali rhodanide under acidic conditions and by precipitation from ethanol, and recovering the serum from the animal.

2. A process of producing an antibody capable of recognising a broad range of sub-types of leukocyte interferons of a species which comprises passing an antiserum capable of recognising such sub-types of leukocyte interferons of a species through a column having a concentrated culture broth of leukocytes of the same species immobilised thereon to absorb leukocyte interferon antibody and then washing the column, followed by elution of the said antibody.

3. A process according to Claim 2, wherein the antiserum is a product obtained by immunising an animal with partially purified human leukocyte interferon which is obtained by purifying a culture, or an extract from a culture, of human leukocytes stimulated to produce interferon, by precipitation with an alkali rhodanide under acidic conditions and by precipitation from ethanol, and recovering the serum from the animal.

4. A method of assaying a sub-type of human leukocyte interferon in a sample, which comprises allowing a polyclonal antibody obtained by a process as claimed in Claim 2 to act on the sample.

5. A method according to Claim 4, wherein the said method is performed by use of an enzyme-antibody method.

6. A method according to Claim 5, wherein the enzyme-antibody method used is a sandwich method.

7. A method according to Claim 6, wherein said sandwich method is conducted using polyclonal antibodies each obtained by a process as claimed in Claim 2 which are each obtained through immunisation of a respective one of two species of animals.

8. A method according to any one of Claims 4 to 7, wherein the leukocyte interferon is a lymphoblast type interferon.

9. A method according to any one of Claims 4 to 7, wherein the leukocyte interferon is a recombinant interferon.

10. A method according to any one of Claims 4 to 9, wherein the specimen is one fractionated by column chromatography.

11. A method according to Claim 10, wherein column chromatography is reverse-phase high performance liquid chromatography.

12. A method of analysing an anti-leukocyte interferon polyclonal antibody, which comprises allowing a subtype fraction of leukocyte interferon obtained by column chromatography to act on the said leukocyte interferon polyclonal antibody.

13. A method according to Claim 12, wherein the anti-leukocyte interferon polyclonal antibody is enzyme-labelled.

14. A method according to Claim 12, wherein the anti-leukocyte interferon polyclonal antibody is a patient's serum.

FIG.1

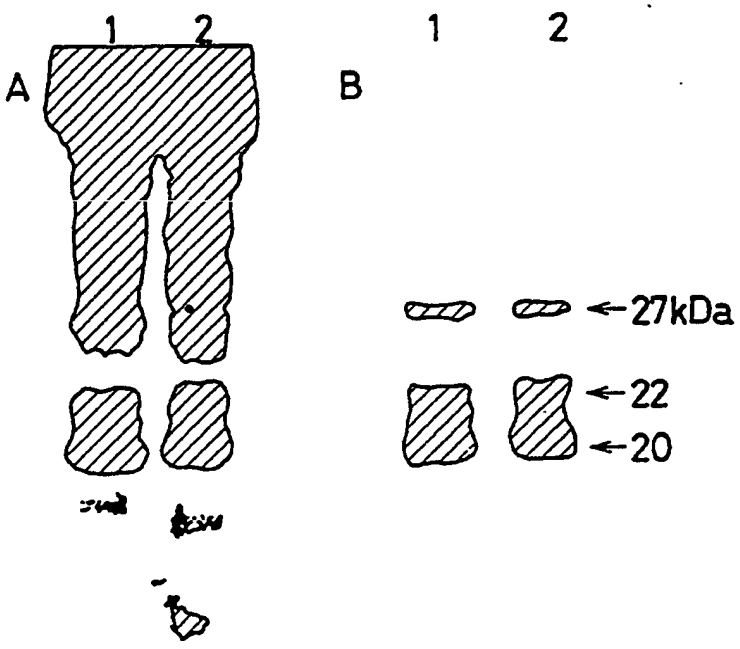
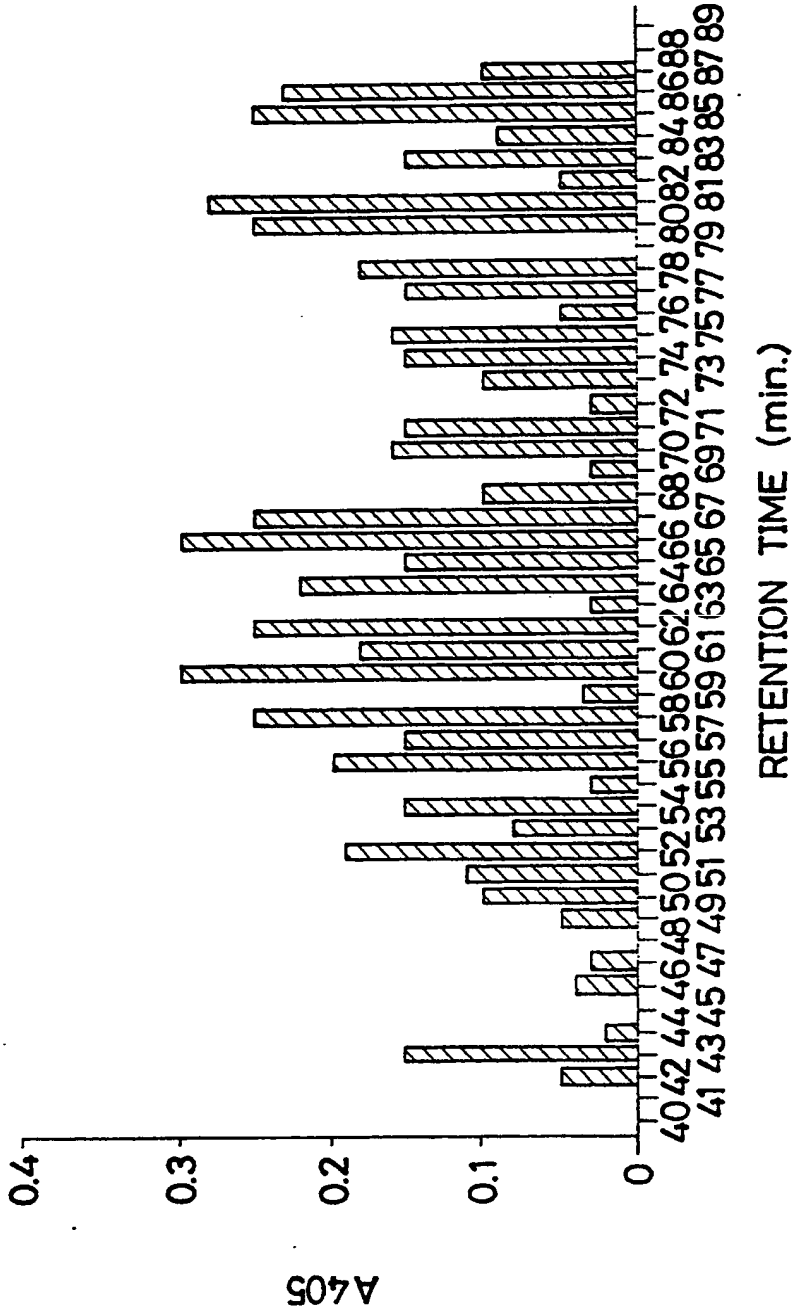


FIG.2


A405
0.4
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0
40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88
41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89
RETENTION TIME (min.)

FIG.3

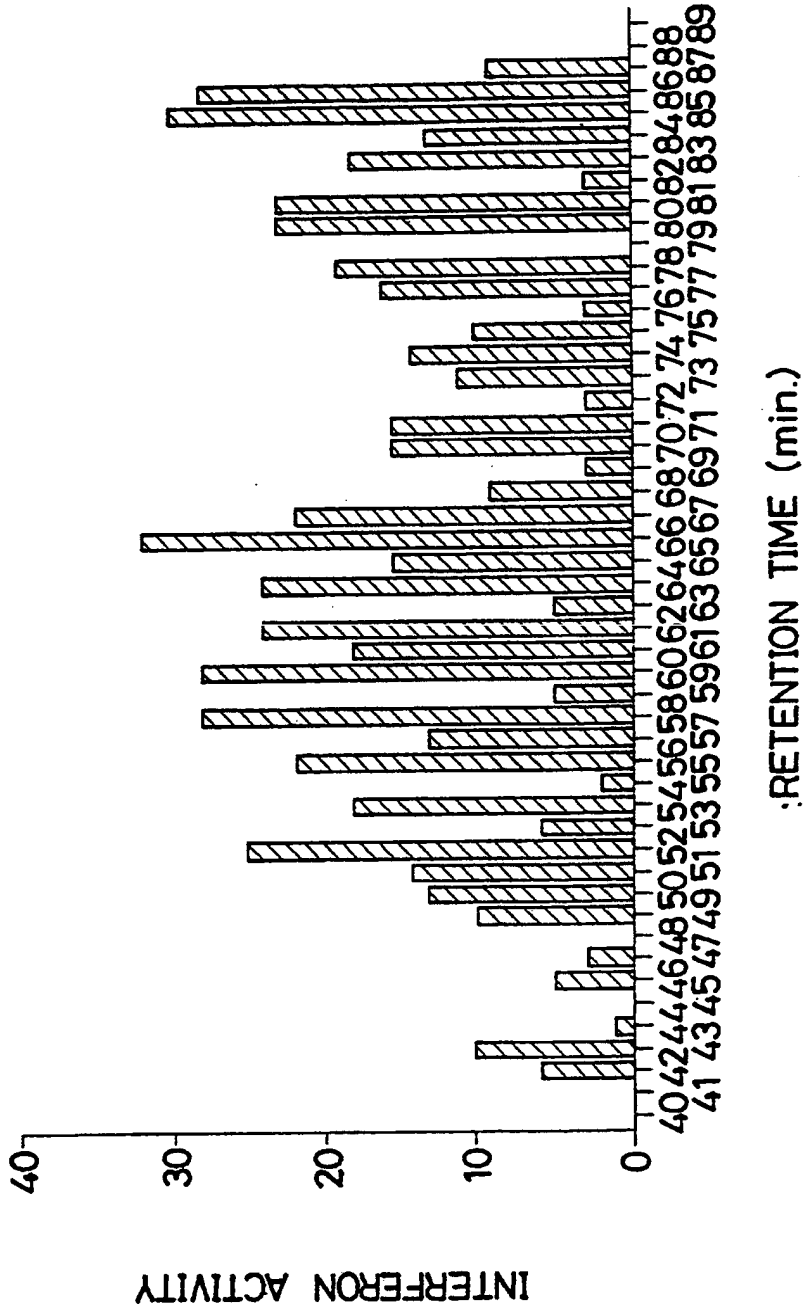
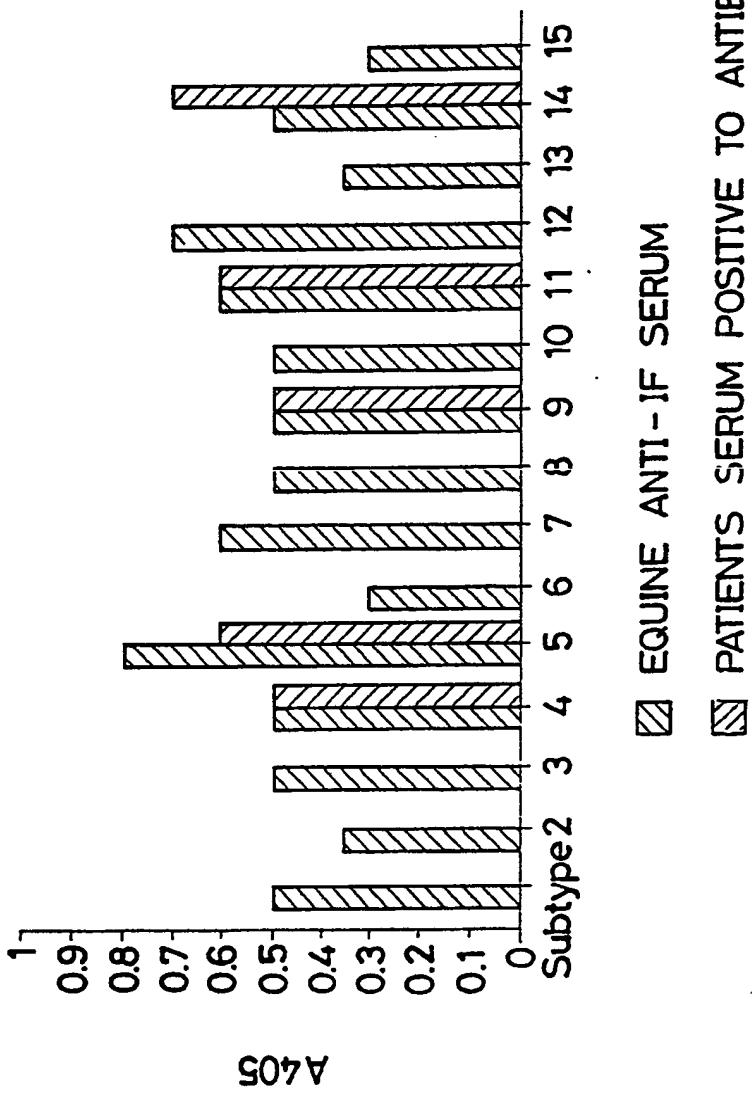

INTERFERON ACTIVITY
0
10
20
30
40
RETENTION TIME (min.)
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89

FIG.4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Subtype2
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15
EQUINE ANTI-IF SERUM
PATIENTS SERUM POSITIVE TO ANTIBODY

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EUROPEAN SEARCH REPORT

Application Number

EP 90 31 3285

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	JOURNAL OF INTERFERON RESEARCH vol. 8, no. supl, December 1988, New York, US page S62 H. SHIRONO et al.: "Study on subtype composition of purified human leukocyte interferon for clinical use." * abstract *	1-14	C07K3/02 C07K3/24 C07K3/18 G01N33/68
Y	DE-A-3906871 (EGIS GYOGYSZERGYAR) * column 1, lines 56 - 58 *	1-14	
D,Y	JOURNAL OF GENERAL VIROLOGY vol. 68, no. 6, June 1987, Colchester, GB pages 1669 - 1676; G. ADOLF: "Antigenic structure of human interferon w1 (interferon aIII)." * page 1672, line 56 - page 1674, line 12 *	1-14	
A	JOURNAL OF IMMUNOLOGY vol. 143, no. 2, 15 July 1989, Baltimore, US pages 507 - 512; I. BARASOAIN et al.: "Antibodies against a peptide representative of a conserved region of human IFN-a." * page 508, right-hand column, lines 20 - 39 *	1-14	TECHNICAL FIELDS SEARCHED (Int. Cl.5) A61K C12P C07K G01N
P,X	JOURNAL OF VIROLOGICAL METHODS vol. 27, no. 1, January 1990, Amsterdam, NL pages 1 - 9; H. SHIRONO et al.: "Studies on subtype composition in natural leukocyte interferon preparations." * the whole document *	1-14	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 MARCH 1991	NOOIJ F.J.M.

CATEGORY OF CITED DOCUMENTS

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